Thought Leadership

Addressing Nickel's Sustainability Paradox

Nickel is key to a sustainable energy transition globally, but its extraction can cause unsustainable outcomes locally. Ensuring a nature positive nickel supply chain is becoming an imperative for producers and consumers alike.

The Biodiversity Consultancy

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Nickel is indispensable to the clean energy transition. Yet the mining practices behind much of the world's nickel supply – concentrated in biodiverse tropical forests and coastal ecosystems – can create social and environmental impacts for local communities and corresponding risks for companies. This briefing sets out how those risks pose material supply chain exposure as well as tangible, collaborative steps companies can take to address them, with examples of leading practice along the value chain.

1. The case for action: why nickel matters

Nickel is a critical enabler of the low-carbon economy. High-nickel battery chemistries deliver higher energy density, longer driving ranges, and lower costs per kWh than current alternatives, making nickel vital for electric vehicles (EV) and grid-scale storage systems. Projections show strong growing demand in the coming decades to serve clean energy applications, requiring a combination of newly mined ore and recycled nickel.

Demand projections at a glance

- Global nickel demand is forecast to double by 2050 (IEA, 2025)
- ~17% of global nickel production currently feeds clean energy applications (IEA, 2025)
- >1 million tonnes/year is required for EV batteries alone by 2030 – roughly one-third of early 2020s total global production (USGS, 2023; Heckens and Worrell, 2020)
- ~2.4 million tonnes/year of clean tech nickel demand projected by 2040 – exceeding 40% of total nickel demand (IEA, 2025)
- Even with 100% recycling by 2050, recycled nickel would meet only ~58% of demand – new mining is unavoidable (Hund et al., 2020)

For original equipment manufacturers (OEMs), battery manufacturers, and other downstream consumers, nickel sourcing is not just an issue for procurement, but is also a strategic area of exposure with direct consequences for product integrity, market access, and enterprise risk.

Environmental and social risks can accumulate along the nickel supply chain (Figure 1), with ore extraction from biodiverse landscapes moving to energy-intensive processing and refining stages, before entering midstream manufacturing to generate battery-grade intermediates, such as mixed hydroxide or sulphide precipitates. These materials are then transformed into materials used directly by downstream battery producers supplying EV and grid-scale energy storage systems.

At each stage of this supply chain, companies face pressure to address their sustainability impacts. However, alongside industry, other actors will play important roles in transforming the nickel value chain:

- governments set licensing frameworks and incentives;
- industry bodies such as its sustainability collaboration ICMM and the Nickel Institute set shared voluntary standards, develop technical guidance, and coordinate collective industry initiatives that shape expectations and practices across the sector;
- communities and other local stakeholders, when meaningfully consulted, can inform responsible mining practices and initiatives that mitigate social and environmental impacts;
- financial institutions influence practices through lending conditions, ESG criteria, and risk management expectations.

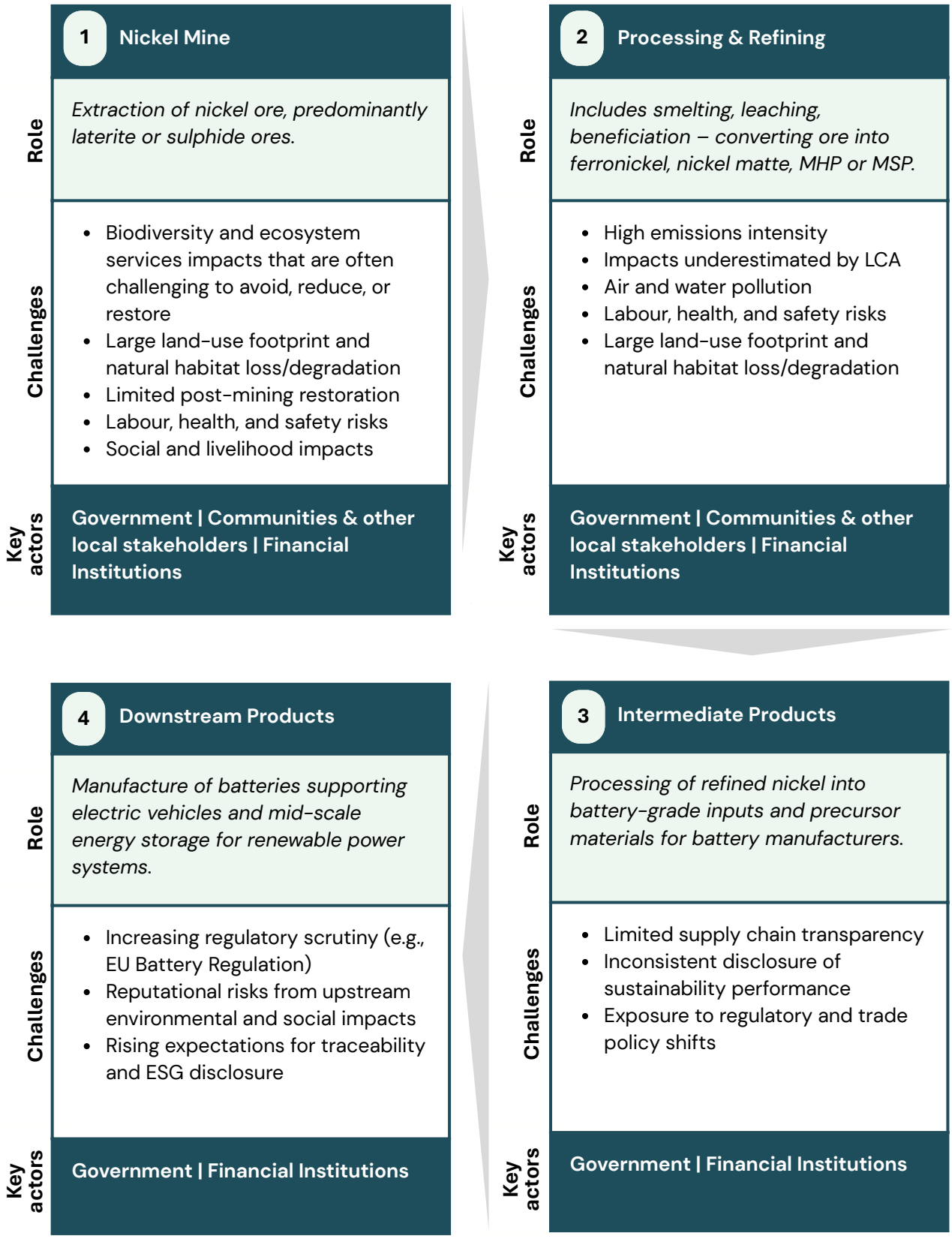

Figure 1. *Sustainability pressures along the nickel supply chain, and key non-corporate actors at each part of the value chain.*

2. Concentration risks and biodiversity at stake

Indonesia now accounts for over 60% of global nickel production – up from 33% in 2019, with production expected to double over the next decade (USGS, 2023; Manubag, 2025). Indonesia is projected to provide up to 74% of global supply by 2040, with overall demand doubling by 2050 (IEA, 2025).

Nickel deposits are sourced from other tropical biodiversity hotspots, including the Philippines and New Caledonia (IEA, 2025). Recent modelling from Hyman et al. (2026) indicates a likely continued increase in nickel supply from deposits in the tropics over the next decade, where laterite ore is formed through weathering of near-surface rocks beneath tropical forest ecosystems, requiring strip mining for extraction (Hyman et al., 2026.). While geographical concentration is advantageous for suppliers, dependency on nickel ores from biodiverse tropical regions poses elevated sustainability risks for downstream buyers.

What makes Indonesia's dominance particularly significant is that its nickel reserves sit within some of the world's most biodiverse and ecologically sensitive landscapes – tropical forests in Sulawesi and North Maluku, and marine ecosystems in Raja Ampat and Southwest Papua that host global concentrations of coral reef biodiversity. In particular, the Morowali region in Central Sulawesi produces one-third of Indonesia's nickel yet faces challenges in transitioning smelters to sources of clean energy (Rahmaditio et al., 2026).

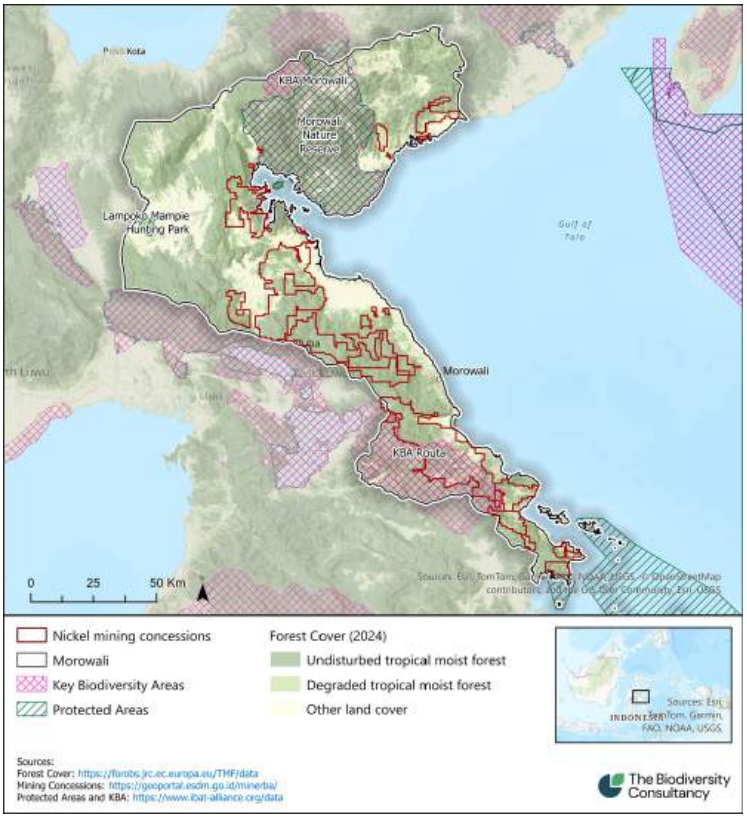

Figure 2. *Nickel mining concession areas in Morowali, Central Sulawesi, and their overlap with Key Biodiversity Areas and protected areas.*

Documented social and environmental impacts from Indonesian nickel operations include:

- **Deforestation and habitat loss:** Concessions in Morowali overlap directly with undisturbed tropical forest and Key Biodiversity Areas (Figure 2), threatening resident forest-dependent species including the Endangered Peleng Tarsier (*Tarsius pelengensis*), the Critically Endangered Maleo bird (*Macrocephalon maleo*), and Celebes Crested Macaque (*Macaca nigra*).

Tarsius pelengensis

Macaca nigra

Macrocephalon maleo

- **Coral reef and coastal degradation:** Expansion of nickel processing facilities in Central Sulawesi has been linked to degraded coastal water quality, with increased sediment-driven turbidity reducing water clarity and impairing conditions essential for coral reef health in biodiversity-rich marine ecosystems (Herho et al., 2026).

- **Water and soil pollution:** Unsustainable mining practices can cause sedimentation, negatively affecting rivers, mangroves, seagrass beds, and coastal fisheries (Syarifuddin, 2022).

- **Carbon-intensive processing:** Extraction and smelting represent 70% of the emissions produced across the nickel value chain. Indonesian nickel production accounted for 22% of the country's total emissions from its energy and industrial sectors in 2023 (WRI Indonesia, 2025; Fauzianto et al., 2025).

- **Social harm:** The overlap of concession areas with community lands has led to land acquisition conflicts, with evidence of negative impacts on social well-being and unequal benefit sharing in some cases (Pambudi, 2022; Lo et al., 2024). There are also reported challenges around limited indigenous and community involvement in decision-making processes, despite national recognition of the right to provide communities with Free, Prior and Informed Consent (Ananda and Fernando, 2025).

3. Business risks are real and growing

These environmental and social impacts are not abstract concerns – they can translate directly into material business risks for downstream buyers of nickel. However, tracing nickel supply chains back to the source is often challenging, making it difficult to clearly attribute impacts and associated risks.

Despite these challenges, companies are facing growing regulatory expectations to strengthen traceability within their critical mineral supply chains. Due diligence regulations in Europe, including the EU Battery Regulation, are encouraging companies to engage early with suppliers to mitigate potential non-compliance or liability with regards to upstream risks.

Risk category	Business implication for downstream buyers
Regulatory and compliance	EU Battery Regulation (from February 2027) mandates full supply chain traceability, with a Digital Battery Passport required for every qualifying battery placed on the EU market. Non-compliant supply chains will be excluded from EU markets.
Biodiversity and litigation	Increasing disclosure and due-diligence laws (e.g., the EU Corporate Sustainability Reporting Directive and Germany's Supply Chain Act – LkSG) expose buyers to liability for nature loss in their supply chains.
Reputational damage	NGO reports, media scrutiny, and investor pressure over deforestation, community conflict, and 'green-washed' ESG claims.
Supply disruption	Community conflicts, permit suspensions, and poor governance create operational disruption risk in heavily concentrated supply chains.
Carbon cost exposure	Carbon-intensive smelters (such as coal-fired plants in Indonesia) generate high Scope 3 emissions; rising carbon pricing mechanisms may penalise buyers of high-carbon nickel.

The ESG gap is structural, not cosmetic. ESG frameworks are often used as financial risk tools or ways of maintaining market access and managing stakeholder expectations through communication, rather than as genuine drivers of environmental and social change. This could be perceived as 'ESG-washing' (Severiano et al., 2024). In Indonesia, for example, ESG regulations can be fragmented and inconsistently enforced. Upstream buyers could find themselves held liable for resulting social and environmental impacts.

Case in point: The EU Battery Regulation

From February 2027, all batteries placed on the EU market must carry a mandatory Digital Battery Passport – a full traceability record covering carbon footprint, material sourcing, and ESG performance across the supply chain (EU Regulation 2023/1542). Companies that cannot demonstrate responsible sourcing will risk market exclusion. This is not a future risk – supply chain mapping and supplier engagement take time and must begin now.

4. What can your company do?

A strategic approach to nickel sourcing requires combining resilience, compliance, and a clear sustainability ambition. The following framework sets out priority actions across three time horizons:

Horizon	Priority actions for OEMs and downstream buyers
Near-term (0–2 years)	• Conduct ESG and biodiversity risk screening across all nickel suppliers • Set minimum sourcing requirements aligned with International Finance Corporation Performance Standards 5–7, Initiative for Responsible Mining or ICMM standards • Begin establishing traceability systems compatible with the EU Battery Passport (mandatory from February 2027) • Engage existing suppliers along the value chain on performance expectations and disclosure requirements
Medium-term (2–5 years)	• Develop preferred-supplier programmes that reward high ESG and biodiversity performance • Co-invest in lower-carbon nickel processing (renewable energy-powered smelting) • Support circularity and recycling partnerships to reduce pressure on primary extraction, increasing use of secondary supply of recovered nickel from recycling to reduce reliance and risk exposure to mined nickel (Hyman et al., 2026.) • Strengthen engagement with communities and local stakeholders, and support nature-positive initiatives
Long-term (over 5 years)	• Shape industry norms for nature-positive nickel alongside governments, industry bodies and peers • Support regional development pathways aligning Indonesia's and other nickel-producing countries' industrial goals with nature • Prioritise low-carbon, high-transparency nickel to future-proof product lines and market access

Companies that act early can secure preferred access to high-performing suppliers, reduce compliance exposure, and differentiate their products in markets increasingly defined by traceability, low-carbon materials, and production that is moving towards positive outcomes for nature. This is particularly important given expectations that there is unlikely to be enough nickel supply to meet projected demand.

Procurement strategies alone are likely to be insufficient, with engagement with producers and capacity building across the nickel supply chain as important early actions companies can take to set strong foundations to harness resilient supply and mitigate emerging risks. Indonesia and other nickel-producing countries have the potential to lead globally on responsible nickel – but downstream buyers have a critical role to play in shaping this trajectory.

Case study: Committing to no net loss of biodiversity in a mining context

The Ambatovy Mine offers a practical example of how mining companies can actively contribute to nature conservation when biodiversity is integrated into project design and operations, even in highly biodiverse locations. Located in Madagascar's eastern rainforest, the mine committed early on to achieving no net loss of forest biodiversity. After applying the mitigation hierarchy to avoid and minimise impacts, the project established one of the largest biodiversity offset programmes in the mining sector. It includes the protection and management of extensive forest areas such as the Ankerana forest corridor, helping maintain ecological connectivity across fragmented landscapes.

Ambatovy's no net loss commitment has required substantial long-term investment, including sustained implementation capacity across four offset sites rather than one-off interventions. Three of these sites are co-managed with local and international NGOs, who work with the company to slow forest clearance through ecological monitoring, supporting community forest management associations, enforcing resource use restrictions, delivering environmental education, and promoting alternative livelihood options in neighbouring communities.

Despite these efforts, illegal activities remain frequent – primarily logging, but also charcoal production, forest fires and land clearing. To bolster protection, community associations have taken on patrolling roles, providing frontline monitoring and reporting of threats. Government engagement has also been pivotal leading to local authorities committing to mobilising additional regional and local personnel to strengthen forest conservation enforcement.

Overall, Ambatovy demonstrates that meaningful outcomes for biodiversity are achievable when companies combine long-term investment, rigorous monitoring, and strong local partnerships.

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Work with us to navigate these risks, from ambition to action

The Biodiversity Consultancy (TBC) specialises in helping companies across the clean energy and manufacturing sectors understand, assess, and manage nature-related risks and opportunities. Since 2006, we have also supported more than 60 leaders in the mining and renewables sectors with implementing effective on-the-ground biodiversity management, aligning with international standards.

Examples of some our services relevant to full mineral-based value chains include:

- Biodiversity risk profiling and hotspot mapping for mining landscapes in biodiverse landscapes globally
- ESG gap analyses against international standards (IFC PS6, IRMA, TNFD)
- Supplier engagement strategies, including capacity building
- Regulatory readiness assessments and advisory
- Nature strategies, target setting and reporting aligned with TNFD, SBTN, and ICMM's Nature Position Statement

Contact the team

If your business depends on critical mineral supply chains.

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